

200 kilobars. These results suggest that the extrapolation past 100 kilobars of the Murnaghan equation for fused silica is not good. It is therefore not impossible that a glass becomes the denser phase at considerably less than the predicted 600 kilobars. In this case, the formation of a glass in these experiments is thermodynamically possible although the glass itself is metastable with respect to coesite. The glass is preserved after shock by the sluggishness of the recrystallization process.

This glassy transition is apparently not peculiar to quartz. In another experiment, an albite ($\text{NaAlSi}_3\text{O}_8$) crystal was transformed to a glass by an over 600 kilobar shock.

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² F. D. Murnaghan, *Finite Deformation of an Elastic Solid* (John Wiley & Sons, Inc., New York, 1951).

³ See, for example, W. Primak, Phys. Rev. **110**, 1240 (1958).

⁴ G. J. F. Mac Donald, Am. J. Sci. **254**, 713 (1956).

⁵ J. C. Jamieson, J. Geol. **65**, 334 (1957).

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Structure of Tetracobaltdodecarbonyl

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TETRACOBALTDODECARBONYL, whose structural determination we have undertaken, crystallizes in the rhombic system with the following unit cell constants: $a = 11.66 \pm 0.07$ Å, $b = 8.94 \pm 0.05$ Å, $c = 17.14 \pm 0.10$ Å, $N = 4$, space group $Pccn$.

The Patterson projections along the three axes may be interpreted by supposing that cobalt atoms are disposed at the vertices of a regular tetrahedron with

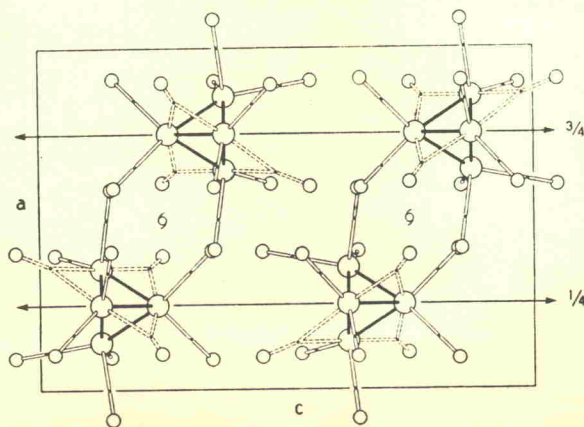


FIG. 1. Projection of the structure on (010), showing the icosahedral arrangement of oxygen atoms within each molecule. Vicariant molecules around the twofold axes $(\frac{1}{4}, \frac{1}{4}, z)$ $(\frac{3}{4}, \frac{3}{4}, z)$ are not drawn.

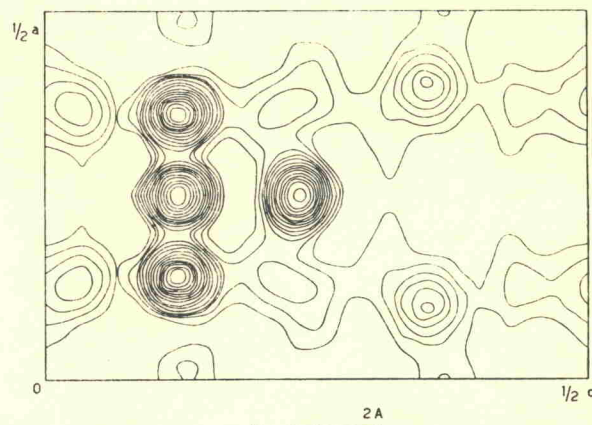


FIG. 2. Preliminary Fourier projection of the electron density on (010). Levels every 4, 6, 8, ... $e/\text{Å}^2$.

fractional coordinates:

	x	y	z
Co(I)	0.250	0.411	0.122
Co(II)	0.358	0.168	0.122
Co(III)	0.142	0.168	0.122
Co(IV)	0.250	0.250	0.240

The cobalt-cobalt distances are 2.50 ± 0.05 Å compared with the value (2.54 Å) quoted for $\text{Co}_2(\text{CO})_8$.¹

The twofold axis $(\frac{1}{4}, \frac{1}{4}, z)$ passes through Co(IV) perpendicularly to the equilateral triangle Co(I)—Co(II)—Co(III) so that statistical vicariance of differently oriented molecules occurs in each site of the crystal, in a manner similar to that described in this journal for $\text{Fe}_3(\text{CO})_{12}$.²

From preliminary Fourier projections along the three axes, it is found, moreover, that oxygen atoms are approximately disposed at the vertices of a regular icosahedron, with an edge of about 4.1 Å. A twofold axis of the icosahedron coincides with the twofold axis $(\frac{1}{4}, \frac{1}{4}, z)$ so that the encumbrance of vicariant molecules is the same as far as it is due to oxygen atoms.

The only possible model of structure, for which the positions found for oxygen and cobalt atoms correlate with reasonable requirements of stereochemical character, is shown projected on the ac plane, in Fig. 1. The corresponding preliminary Fourier projection is shown in Fig. 2. The molecule possesses a noncrystallographic

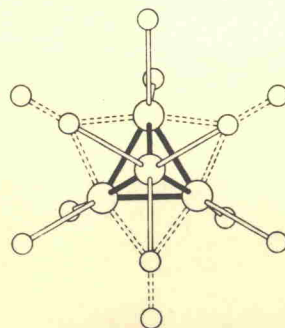


FIG. 3. Model of the molecule of $\text{Co}_4(\text{CO})_{12}$ viewed down the threefold (noncrystallographic) symmetry axis.